

Application No. 10/718,884  
Response to Office Action

Customer No. 01933

Listing of Claims:

1. (Currently Amended) An illumination apparatus for a microscope, comprising:

a light source for white light;

beam splitting means for splitting a light beam emitted from the light source into a plurality of beams of irradiation light;

wavelength-selective means, provided on optical paths of illumination the beams of irradiation light split by the beam splitting means, to select for selecting wavelengths of the illumination beams of irradiation light; [[,]] and

beam synthesizing mean means for synthesizing the plurality of beams of irradiation light whose wavelengths are selected, into a single light beam.

2. (Currently Amended) An illumination apparatus for a microscope, comprising:

a light source for white light; [[,]]

beam splitting means for splitting a light beam emitted from the light source into beams of first irradiation light and second irradiation light;

first wavelength-selective means for selecting a wavelength of the first irradiation light;

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10 second wavelength-selective means for selecting a wavelength of the second irradiation light; and

beam synthesizing means for synthesizing the beams of the first irradiation light whose wavelength is selected and the second irradiation light whose wavelength is selected, into a single light beam.

3. (Currently Amended) An illumination apparatus for a microscope, comprising:

a light source for white light;

5 beam splitting means for splitting a light beam emitted from the light source into a plurality of beams of irradiation light;

wavelength-selective means, provided on optical paths of illumination the beams of irradiation light split by the beam splitting means, to select for selecting wavelengths of the illumination beams of irradiation light;

10 beam synthesizing mean means for synthesizing the plurality of beams of irradiation light whose wavelengths are selected, into a single light beam;

a mirror for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is 15 irradiated and for transmitting light from the specimen;

an objective lens interposed between the mirror and the specimen;

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imaging elements for imaging fluorescent light from the specimen, passing which passes through the objective lens and the 20 mirror, after being the fluorescent light is separated into fluorescent light excited by individual wavelengths; and image processing means for processing fluorescent images formed by the imaging elements.

4. (Currently Amended) An image processing apparatus using an illumination apparatus, the illumination apparatus comprising:  
a light source for white light;  
beam splitting means for splitting a light beam emitted from 5 the light source into a plurality of beams of irradiation light;  
wavelength-selective means, provided on optical paths of illumination the beams of irradiation light split by the beam splitting means, to select for selecting wavelengths of the illumination beams of irradiation light;  
beam synthesizing ~~mean~~ means for synthesizing the plurality 10 of beams of irradiation light whose wavelengths are selected, into a single light beam;  
a mirror for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is 15 irradiated and for transmitting light from the specimen;  
an objective lens interposed between the mirror and the specimen;

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imaging elements for imaging fluorescent light from the specimen, passing which passes through the objective lens and the 20 mirror, after being the fluorescent light is separated into fluorescent light excited by individual wavelengths; and image processing means for processing fluorescent images formed by the imaging elements.

5. (Currently Amended) An illumination apparatus for a microscope, comprising:

a light source for white light;  
beam splitting means for splitting a light beam emitted from 5 the light source into two beams of first irradiation light and second irradiation light;

first wavelength-selective means for selecting a wavelength of the first irradiation light; [ , ]

second wavelength-selective means for selecting a wavelength 10 of the second irradiation light; [ , ]

beam synthesizing means for synthesizing the beams of the first irradiation light whose wavelength is selected and the second irradiation light whose wavelength is selected, into a single light beam;

15 a mirror for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is irradiated and for transmitting light from the specimen;

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an objective lens interposed between the mirror and the specimen;

20 imaging elements for imaging fluorescent light from the specimen, passing which passes through the objective lens and the mirror, after being the fluorescent light is separated into fluorescent light excited by a first wavelength and fluorescent light excited by a second wavelength and forming an image; and  
25 image processing means for processing fluorescent images formed by the imaging element.

6. (Currently Amended) An image processing apparatus using an illumination apparatus, the illumination apparatus comprising:

a light source for white light;

beam splitting means for splitting a light beam emitted from the light source into two beams of first irradiation light and second irradiation light;

first wavelength-selective means for selecting a wavelength of the first irradiation light; [ , ]

10 second wavelength-selective means for selecting a wavelength of the second irradiation light; [ , ]

beam synthesizing means for synthesizing the beams of the first irradiation light whose wavelength is selected and the second irradiation light whose wavelength is selected, into a single light beam;

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15 a mirror for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is irradiated and for transmitting light from the specimen;

an objective lens interposed between the mirror and the specimen;

20 imaging elements for imaging fluorescent light from the specimen, passing which passes through the objective lens and the mirror, after being the fluorescent light is separated into fluorescent light excited by a first wavelength and fluorescent light excited by a second wavelength ~~and forming an image~~; and

25 image processing means for processing fluorescent images formed by the imaging element.

7. (Currently Amended) An illumination apparatus for a microscope, comprising:

a light source for white light;

beam splitting means for splitting a light beam emitted from the light source into a plurality of beams of irradiation light, wavelength-selective means, provided on optical paths of illumination the beams of irradiation light split by the beam splitting means, to select for selecting wavelengths of the illumination beams of irradiation light;

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10       beam synthesizing mean means for synthesizing the plurality  
of beams of irradiation light whose wavelengths are selected,  
into a single light beam;  
          a first objective lens for introducing the light beam  
synthesized by the beam synthesizing means in a direction in  
15       which a specimen is irradiated;  
          a second objective lens placed opposite to the first  
objective lens, with such that the specimen is positioned  
between the first objective lens and the second objective lens;  
          imaging elements for imaging fluorescent light from the  
20       specimen passing that passes through the second objective lens,  
after being the fluorescent light is separated into fluorescent  
light excited by individual wavelengths, and  
          image processing means for processing fluorescent images  
formed by the imaging elements.

8. (Currently Amended) An image processing apparatus using  
an illumination apparatus, the illumination apparatus comprising:  
          a light source for white light;  
          beam splitting means for splitting a light beam emitted from  
5       the light source into a plurality of beams of irradiation light,  
          wavelength-selective means, provided on optical paths of  
illumination the beams of irradiation light split by the beam

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splitting means, ~~to select~~ for selecting wavelengths of the  
illumination beams of irradiation light;

10 beam synthesizing ~~mean~~ means for synthesizing the plurality  
of beams of irradiation light whose wavelengths are selected,  
into a single light beam;

15 a first objective lens for introducing the light beam  
synthesized by the beam synthesizing means in a direction in  
which a specimen is irradiated;

a second objective lens placed opposite to the first  
objective lens, ~~with such that the specimen is positioned~~  
between the first objective lens and the second objective lens;

20 imaging elements for imaging fluorescent light from the  
specimen ~~passing that passes~~ through the second objective lens,  
after ~~being the fluorescent light is~~ separated into fluorescent  
light excited by individual wavelengths, and

image processing means for processing fluorescent images  
formed by the imaging elements.

9. (Currently Amended) An illumination apparatus for a  
microscope, comprising:

a light source for white light;

5 beam splitting means for splitting a light beam emitted from  
the light source into beams of first irradiation light and second  
irradiation light;

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first wavelength-selective means for selecting a wavelength of the first irradiation light;

10 second wavelength-selective means for selecting a wavelength of the second irradiation light;

beam synthesizing means for synthesizing the beams of the first irradiation light whose wavelength is selected and the second irradiation light whose wavelength is selected, into a single light beam;

15 a first objective lens for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is irradiated;

20 a second objective lens placed opposite to the first objective lens, with such that the specimen is positioned between the first objective lens and the second objective lens;

25 imaging elements for imaging fluorescent light from the specimen passing that passes through the second objective lens, after being the fluorescent light is separated into fluorescent light excited by a first wavelength and fluorescent light excited by a second wavelength; and

image processing means for processing fluorescent images formed by the imaging elements.

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10. (Currently Amended) An image processing apparatus using an illumination apparatus, the illumination apparatus comprising:

a light source for white light;

5 beam splitting means for splitting a light beam emitted from the light source into beams of first irradiation light and second irradiation light;

first wavelength-selective means for selecting a wavelength of the first irradiation light;

10 second wavelength-selective means for selecting a wavelength of the second irradiation light;

beam synthesizing means for synthesizing the beams of the first irradiation light whose wavelength is selected and the second irradiation light whose wavelength is selected, into a single light beam;

15 a first objective lens for introducing the light beam synthesized by the beam synthesizing means in a direction in which a specimen is irradiated;

a second objective lens placed opposite to the first objective lens, ~~with such that the specimen is positioned~~  
20 between the first objective lens and the second objective lens;

imaging elements for imaging fluorescent light from the specimen passing that passes through the second objective lens, after being the fluorescent light is separated into fluorescent

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light excited by a first wavelength and fluorescent light excited  
25 by a second wavelength; and

image processing means for processing fluorescent images  
formed by the imaging elements.

11. (Currently Amended) An illumination apparatus for a microscope according to claim 3 or 7, further comprising light-amount adjusting means for adjusting an intensity of at least one of the plurality of beams of irradiation light.

12. (Currently Amended) An image processing apparatus according to claim 4 or 8, wherein the illumination apparatus further comprises light-amount adjusting means for adjusting an intensity of at least one of the plurality of beams of irradiation light.

13. (Currently Amended) An illumination apparatus for a microscope according to claim 5 or 9, further comprising ~~both at least one of:~~ (a) first light-amount adjusting means for adjusting an intensity of the first irradiation light and  
5 (b) second light-amount adjusting means for adjusting an intensity of the second irradiation light, ~~or one of the first light amount adjusting means and the second light amount adjusting means.~~

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14. (Currently Amended) An image processing apparatus according to claim 6 or 10, wherein the illumination apparatus further comprises ~~both~~ at least one of: (a) first light-amount adjusting means for adjusting an intensity of the first 5 irradiation light and (b) second light-amount adjusting means for adjusting an intensity of the second irradiation light, ~~or one of the first light amount adjusting means and the second light amount adjusting means.~~

15. (Currently Amended) An illumination apparatus for a microscope according to claim 3 or 7, further comprising polarization direction selective means for selecting a polarization direction of at least one of the plurality of beams of irradiation light.

16. (Currently Amended) An image processing apparatus according to claim 4 or 8, wherein the illumination apparatus further comprises polarization direction selective means for selecting a polarization direction of at least one of the plurality of beams of irradiation light.

17. (Currently Amended) An illumination apparatus for a microscope according to claim 5 or 9, further comprising ~~both~~ at least one of: (a) first polarization direction selective means

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for selecting a polarization direction of the first irradiation  
5 light and (b) second polarization direction selective means for  
selecting a polarization direction of the second irradiation  
light, ~~or one of the first polarization direction selective~~  
~~means and the second polarization direction selective means.~~

18. (Currently Amended) An image processing apparatus  
according to claim 7 or 10, wherein the illumination apparatus  
further comprises ~~both at least one of:~~ (a) first polarization  
direction selective means for selecting a polarization direction  
5 of the first irradiation light and (b) second polarization  
direction selective means for selecting a polarization direction  
of the second irradiation light, ~~or one of the first~~  
~~polarization direction selective means and the second~~  
~~polarization direction selective means.~~

19. (Currently Amended) An illumination apparatus for a  
microscope according to claim 3 or 7, further comprising  
wavelength distribution monitoring means for monitoring a  
wavelength distribution of at least one of the plurality of beams  
of irradiation light.

20. (Currently Amended) An image processing apparatus  
according to claim 4 or 8, wherein the illumination apparatus  
further comprises wavelength distribution monitoring means for

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monitoring a wavelength distribution of at least one of the plurality of beams of irradiation light.

21. (Currently Amended) An illumination apparatus for a microscope according to claim 5 or 9, further comprising wavelength distribution monitoring means for monitoring ~~both at least one of:~~ a wavelength distribution of the first irradiation light and a wavelength distribution of the second irradiation light, ~~, or one of the wavelength distribution of the first irradiation light and the wavelength distribution of the second irradiation light.~~

22. (Currently Amended) An image processing apparatus according to claim 6 or 10, wherein the illumination apparatus further comprises wavelength distribution monitoring means for monitoring ~~both at least one of:~~ a wavelength distribution of the first irradiation light and a wavelength distribution of the second irradiation light, ~~, or one of the wavelength distribution of the first irradiation light and the wavelength distribution of the second irradiation light.~~

23. (Currently Amended) An illumination apparatus for a microscope according to claim 3 or 5, wherein the mirror ~~is comprises~~ a semi-transmissive mirror.

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24. (Currently Amended) An image processing apparatus according to claim 4 or 6, wherein the mirror ~~is~~ comprises a semi-transmissive mirror.

25. (Currently Amended) An illumination apparatus for a microscope according to any one of ~~claim~~ claims 3, 5, 7, or 9, wherein the beam splitting means and the beam synthesizing means ~~are~~ comprise dichroic mirrors.

26. (Currently Amended) An image processing apparatus according to any one of ~~claim~~ claims 4, 6, 8, or 10, wherein the beam splitting means and the beam synthesizing means ~~are~~ comprise dichroic mirrors.

27. (Currently Amended) An illumination apparatus for a microscope according to any one of ~~claim~~ claims 3, 5, 7, or 9, wherein the beam splitting means and the beam synthesizing means ~~are~~ comprise polarization beam splitters.

28. (Currently Amended) An image processing apparatus according to any one of ~~claim~~ claims 4, 6, 8, or 10, wherein the beam splitting means and the beam synthesizing means ~~are~~ comprise polarization beam splitters.

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29. (Currently Amended) An illumination apparatus for a microscope according to claim 3 or 7, wherein ~~at least one of the wavelength-selective means comprises~~ a plurality of wavelength-selective means, ~~at least one of which is placed to be~~ 5 movable in and out of an optical path split by the beam splitting means.

30. (Currently Amended) An image processing apparatus according to claim 4 or 8, wherein ~~at least one of the wavelength-selective means comprises~~ a plurality of wavelength-selective means, ~~at least one of which is placed to be~~ 5 movable in and out of an optical path split by the beam splitting means.

31. (Currently Amended) An illumination apparatus for a microscope according to claim 5 or 9, wherein at least one of the first wavelength-selective means and the second wavelength-selective means is ~~placed to be~~ movable in and out of an optical path split by the beam splitting means.

32. (Currently Amended) An image processing apparatus according to claim 6 or 10, wherein at least one of the first wavelength-selective means and the second wavelength-selective

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means is ~~placed to be~~ movable in and out of an optical path split by the beam splitting means.

33. (New) An illumination apparatus for a microscope, comprising:

a light source for white light;

beam splitting means for splitting a light beam emitted from 5 the light source into a plurality of light beams of illumination light;

wavelength-selective means, provided on at least one of a plurality of optical paths of the beams of illumination light split by the beam splitting means, for selecting wavelengths of 10 the beams of illumination light;

beam synthesizing means for synthesizing the plurality of beams of illumination light whose wavelengths are selected, into a single light beam;

optical elements that introduce the light beam synthesized 15 by the beam synthesizing means to a specimen;

image pickup elements that separately pick up, out of light beams for observation emitted from the specimen, light beams for observation generated by irradiation with illumination light of different wavelengths that is separated by wavelength; and

20 image processing means for processing images for observation picked up by the image pickup elements.

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34. (New) An image processing apparatus using an illumination apparatus, the illumination apparatus comprising:

5 a light source for white light;

beam splitting means for splitting a light beam emitted from the light source into a plurality of light beams of illumination light;

10 wavelength-selective means, provided on at least one of a plurality of optical paths of the beams of illumination light split by the beam splitting means, for selecting wavelengths of the beams of illumination light;

beam synthesizing means for synthesizing the plurality of beams of illumination light whose wavelengths are selected, into a single light beam;

15 optical elements that introduce the light beam synthesized by the beam synthesizing means to a specimen;

image pickup elements that separately pick up, out of light beams for observation emitted from the specimen, light beams for observation generated by irradiation with illumination light of different wavelengths that is separated by wavelength; and

20 image processing means for processing images for observation picked up by the image pickup elements.